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13. ABSTRACT (Maximum 200 Words) The goal of this Training Program is to direct talented undergraduates into careers in breast cancer research. The program, called <u>Breast Cancer Undergraduate Research Experience (BCURE)</u> , is a joint program between The University of Maryland Baltimore County (UMBC) and the University of Maryland, Baltimore Medical School (UM,B). The centerpiece of BCURE is a full-time, 10-week summer research experience in the laboratory of an established investigator (mentor) working in breast cancer research. Ten UMBC and UM,B faculty, whose research programs focus on breast cancer, serve as mentors. The Program Director is a well-respected breast cancer investigator who has personally trained >50 undergraduates. Trainees also participate in a Breast Cancer Course and an optional Biomedical Research Ethics course. Trainees present their projects at laboratory meetings, program conferences, UMBC Undergraduate Research Day, as well as at national and international meetings, if appropriate, and in research activities such as journal clubs and seminars. They meet regularly with the Program Director and formally present their research at Breast Cancer Research Day. BCURE trainees include UMBC and non-UMBC undergraduates and represent the diverse population in the Baltimore area. The program includes eight trainees per summer.				
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INTRODUCTION

The development of successful approaches for the prevention and treatment of breast cancer is completely dependent on well-trained, creative, and highly motivated research scientists studying breast biology and breast cancer. It is, therefore, critically important to direct our most talented young investigators into breast cancer research. The goal of the BCURE program is to direct undergraduate students into careers in breast cancer research. Students frequently focus on a particular research question based on an early, successful research experience in that area. By exposing undergraduate students to breast cancer research early during their studies, and giving them an outstanding research experience, we optimize the chances they will focus their research career on breast cancer. There is an existing large pool of UMBC undergraduate students who are academically talented and highly motivated and anxious to be involved in biomedical research. This program will provide these talented undergraduates with opportunities to participate in breast cancer research within the context of their undergraduate education. They will gain valuable experience in a specific area of breast cancer research and focus, and possibly solve, important research questions. In addition, the trainees will be exposed to other areas of breast cancer research through a special Breast Cancer Course and Breast Cancer Research Day. These events will enable students to gain a perspective on the breadth and depth of breast cancer research, and may suggest additional research areas for them to pursue as graduate students and/or post-doctoral fellows, or when they start their own laboratories as independent investigators. Our training faculty (mentors) are well-respected investigators in various areas of breast cancer research, and come from university, medical school, and cancer center settings. They have experience training undergraduates, and are enthusiastic about working with them. They are also very aware of the requirements for training undergraduates vs. graduate or post-doctoral students.

BODY

Key Research Accomplishments:

For the summer 2003 BCURE program:

- ▶ Advertised the BCURE program on the UMBC website and announced it in many undergraduate sciences classes
- ▶ Interviewed applicants and selected eight, high-achieving students to be the third BCURE class (2003 class)
- ▶ Designed the BCURE summer lecture class and made arrangements for five experts in breast cancer plus the PI to present their work for the trainees
- ▶ Assigned eight BCURE students for 200e to their mentors by matching research interests and personalities
- ▶ Held the second annual BCURE meeting which served as an orientation for the BCURE 2003 trainees
- ▶ Met regularly throughout the summer of 2003 with the trainee group. Each trainee presented the status of their project at each meeting.

- ▶ Regularly contacted the mentors throughout the summer of 2003 to find out how each BCURE trainee was performing and if there were any problems
- ▶ Trainees presented their research projects in poster format at the end-of-the-summer undergraduate research "fest" at UMBC in August 2003
- ▶ Four of the eight trainees continued to work in their mentors' research laboratory through part or all of the academic year (2003-2004)
- ▶ Trainees presented the final version of their projects in poster format at "Breast Cancer Research Day," in April 2003, an annual event featuring the trainees and an outside speaker/expert in breast cancer. (See "Reportable Outcomes")
- ▶ Completed a survey of the 2001, 2002, and 2003 BCURE trainees to ascertain the impact of the BCURE program. The results of this evaluation are given at the end of "Reportable Outcomes."

Reportable Outcomes:

- ▶ Eight undergraduate trainees worked during the summer of 2002 for 10 weeks each with individual faculty mentors studying basic questions in breast cancer.
- ▶ Four trainees continued working in their mentors' laboratories during the academic year (2003-2004)
- ▶ One trainee from the BCURE 2003 applied for and received an American Association for Cancer Research (AACR) travel award to attend the AACR annual conference in 2004 and 2005 (2004 conference was in Orlando, FL).
- ▶ All trainees presented their final projects in poster format at the annual "Breast Cancer Research Day" in April 2004. Dr. Patricia Steeg from the NIH, NCI was the invited outside breast cancer expert. This event is a university-wide function at which an outside expert in breast cancer research presents his/her work and interacts with each student.
- ▶ Several of the BCURE 2001 and 2002 students started graduate programs; please see the following summary for specifics.

Summary Evaluation of the 3 year BCURE Program

An evaluation of the BCURE Program at UMBC was conducted by sending out 14-question questionnaires via e-mail to all 24 BCURE students with a note explaining the plans to seek additional funds for the program, which was slated to end in May 2004 because the Department of Defense was no longer funding undergraduate research programs. Participants were told that a survey was needed to evaluate the impact of the BCURE Program, especially its effect on their educational and career goals. The questionnaire consisted of 13 short-answer and an additional question (#10) asked participants to rate 10 components of the program using a range of 1 to 5 with "1" being the most helpful and "5" being the least helpful. Twenty-one or 87.5 percent of the participants returned their questionnaires by the date of this evaluation. BCURE Program Coordinator Kathy Lee Sutphin reviewed the questionnaire responses because

grant support did not provide funds for an evaluation consultant. Some responses were summarized and/or paraphrased and all questionnaires have been retained to support the evaluation results. Following is a summary of the responses; a detailed report (not included) contains a question-by-question analysis of the responses.

Summary of Responses

- 1) Of the 21 respondents, 17 are full-time undergraduate students, one is a graduate student pursuing a PhD in Immunology, one is a first year medical student and two have earned their baccalaureate degrees and are working at Johns Hopkins University. Of the 17 undergraduates, eleven are biology majors, five are biochemistry majors, and one is a chemical engineering major with a biology track.
- 2) Sixty-two percent of the respondents said that the BCURE Program influenced their program or job and 38% said that it did not. Ninety percent said the BCURE Program helped them in some way with their current program or job.
- 3) Eleven of the 21 respondents identified PhD or MD/PhD as their long term educational or career goals, six identified medical school, one identified pharmacy school, one identified DDS and one plans to be a chemical engineer. Eighteen persons representing 85 percent of the respondents answered that their long-term career goals included research or possible research, two answered they did not plan a research career and one was still deciding.
- 4) All 21 respondents said that participation in the BCURE Program at UMBC significantly increased their awareness of breast cancer disease and treatments. Eleven said that they anticipated that they would promote early detection and improved treatment, nine said this awareness would influence career goals and performance, four said this awareness made them realize the value of breast cancer research, four said it would increase their support of fundraising activities and three said it increased their empathy for breast cancer victims and their loved ones.
- 5) In rating the helpfulness of the program components, respondents rated the research experience with the BCURE Mentor and the requirement to write an abstract and create a scientific poster as the most helpful with the highest averages of 1.095. Participation in the Annual BCURE Breast Cancer Research Day followed with an average rating of 1.143 followed closely by opportunities to explain own research projects at the summer seminars with a rating of 1.190. The summer stipend support was next on the rating list with an average of 1.333 followed by the BCURE Research Day stipend support at 1.400. Camaraderie/interaction with other BCURE Trainees was also rated as helpful with a 1.476 average rating followed by the regular BCURE summer seminars with guest lecturers at 1.571. Of the ten components, the exposure/interaction with the BCURE

Research Day Keynote Speaker received the lowest average with a 2.095, which was still a positive rating within the 1 to 5 rating scale.

- 6) In the short answer question about which component was the most helpful, seven respondents identified their research experience with their mentor and one additional person identified the support they had received from their mentor, Mrs. Sutphin and Dr. Rosenberg. Four respondents identified the interaction and sharing research with the other participants and three noted that opportunities to present research and/or the BCURE Breast Cancer Research Day were the most helpful. Two participants responded that being part of a research lab was most helpful and two more identified the actual research. Another student identified the comprehensive nature of the program and its many interrelated components as most helpful and one student identified the program's policy to admit foreign students.
- 7) All 21 respondents said that they would recommend the program to others. A summary of some of the comments includes: "Great opportunity," "Learned a lot and had fun," "Very informative," "Great way to find out if research is part of your future," "Good chance to evaluate career decision," and "Opened my eyes to other career choices."
- 8) Although nine participants either responded that they could not think of any changes needed to the BCURE Program or didn't respond, 12 respondents made suggestions, which are paraphrased as follows:
 - More presentations beyond scope of UMBC, perhaps at a national conference
 - More students
 - UM,B lectures in the morning instead of afternoon so they don't interfere with research
 - Better organization in interactions with UM,B
 - Encourage more trainee interaction (2)
 - Make research the year after the summer experience a requirement
 - Increased financial compensation/stipend not sufficient for self-supporting students
 - Encourage alums to interact with new trainees
 - Make Research Day in the fall
 - Lengthen duration of the research component
 - Provide more information about reading scientific articles and what to expect with

first research experience

12) Six respondents had no final comments but four commented on the value of the opportunity, three stated their appreciation for being able to participate in the program, and two emphasized the importance of continuing the program. Other comments are paraphrased as follows:

- Excellent program, changed me to a better student
- Thoroughly enjoyed the program
- Overall very positive – challenging without being overwhelming
- Allowed me to discover an interest toward research that I didn't know existed
- Incredibly valuable part of my undergraduate education, helping me to discover my desire to participate in biomedical research and teaching me skills that will remain with me throughout my career
- Participation in the program lead to a Pfizer fellowship and (after graduation) I was hired by a lab at Johns Hopkins University

A review of the responses indicates that the BCURE Program was effective in 1) educating participants about breast cancer disease and treatment, 2) helping students gain the skill and knowledge to work in research laboratories, 3) ensuring that participants had positive undergraduate research experiences, 4) preparing participants to present their research, and 5) encouraging students to think about cancer research, specifically breast cancer research, as a career choice. The true measure of the effectiveness will be reached in future years when more of the BCURE Program participants have completed their baccalaureate degrees and have continued toward their chosen educational and/or career paths.

CONCLUSIONS

The BCURE program at UMBC has now been operating for three years and we have trained 24 students in a variety of areas of breast cancer research. Based on feedback from the participating students and from their mentors, the BCURE program has been exceptionally successful in raising students' awareness of breast cancer and in exposing them to career paths that involve significant breast cancer research. As stated in last year's annual report, we are very disappointed that the DOD is cancelling this undergraduate research program since we feel it has tremendous impact on students at a very impressionable stage of their training. Based on our 3 year experience, the relatively small investment in students at this early point in their training pays off substantially since many of them are incorporating research into their careers. We are actively looking for alternative funding sources to continue this successful program and currently have a pending R25 application with the NIH, NCI. We feel strongly that training the next generation of scientists is imperative for finding a cure for breast cancer and we are frustrated that this highly successful and innovative program will terminate due to lack of funds.